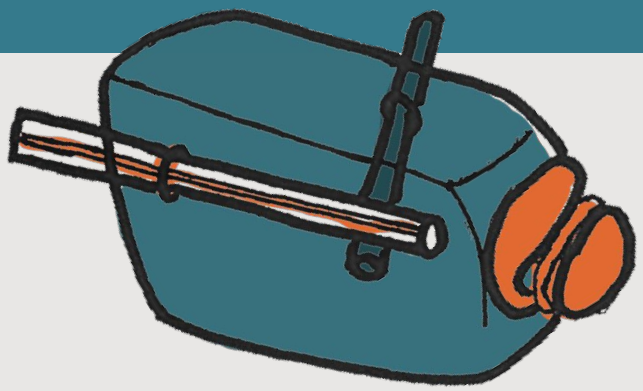
BOTTLE FLUTE

MIDDLE SCHOOL LEVEL 1



The flute is a musical instrument in the woodwinds family. It is unique in its category of instruments because it's reedless and produces sound by the flow of air across an opening. The bottle flute is easy to make, fun to play, and will fit right in with our recycled symphony. We used a small plastic container for ours, but try some other shapes and sizes.

EDUCATIONAL STANDARDS:

NGSS CONNECTION:
MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

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COMMON CORE CONNECTION:
ELA/Literacy

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

Mathematics
MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

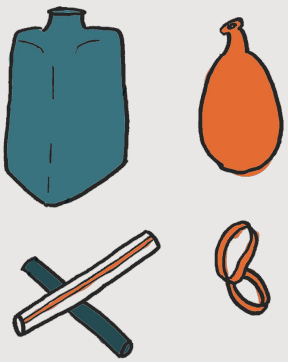
6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems.

7.RP.A.2 Recognize and represent proportional relationships between quantities.

8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

DOK:
Level 3: Strategic Thinking
Level 4: Extended Thinking

MATERIALS NEEDED:



- ❏ Plastic bottle
- ❏ Rubber bands
- ❏ A balloon
- ❏ 2 large straws

DIRECTIONS:

1. Drill a hole in the center of the bottom of the bottle, the same size as your straw. This should be as tight a fit as possible to allow for adjustment in sound.

2. Drill another hole, the same size, on the side of the bottle. This will be the straw you blow through.

3. Put your straws through the holes. The straw from the side, the blow straw, should be glued in place. The straw from the bottom will stay loose to change the pitch of your flute.

4. Cut off the top of the balloon, at about the center, and put the balloon over the top of the open bottle, attach it with the rubber band.

5. Push the straw up through the bottom of the bottle to the balloon skin. The vibrations of air on the balloon will change the pitch and tone played.

6. Cut a small hole in the straw that comes up through the bottom. Covering and uncovering the hole while blowing through the mouth straw will change the tone.

OBJECTIVE:

Students will be able to investigate the differences between transverse and longitudinal wave pulses through guided inquiry.

ESSENTIAL QUESTION:

- What causes the change in the number of standing waves?

ENGAGE / EXPLORE

1. Explain to students that his module will lead up to them inventing and building musical instruments

EXPLAIN:

1. Demonstrate wave pulses for students an how to measure the amplitude
    a. Transverse
    b. Longitudinal
2. The Essential Question for this inquiry
    a. "Does the amplitude of a wave affect wave speed?"
        i. Students design an experiment to answer this question
        ii. Use telephone cord or slinky (we prefer phone cords)
3. Students use the scientific method to respond to the question
    a. State the purpose and make a hypothesis
    b. Think about the measurement tools, controls, and variables
    c. Students record data. Students analyze their data
        i. Look for trends or patterns
        ii. Draw conclusions based on their data
4. Introduce and demonstrate standing waves
    a. Frequency
        i. "Does frequency have an effect on the speed of a wave?"
    b. Students shake the telephone cords
        i. Model of standing wave in the fundamental frequency
        ii. "This is a standing wave with half of one wave."
    c. Teacher continues to wiggle the cord making standing waves
        i. Point out the nodes and the antinodes
        ii. Count how many half-waves there are.
    d. Questions for students
        i. Can they figure out how to make a standing wave with different numbers of half-waves (loops)
        ii. Students or facilitator forms cooperative groups for investigation
        iii. Teacher solicits responses from students

ELABORATE:

1. Analysis of experimental data
    a. Students should answer the questions on the handout.
    b. Synthesizing and analyzing their findings from their lab
2. Students discover that wave speed does not change with frequency or wavelength
    a. Wavelength is constant (within experimental error) if tension remains constant
3. Teacher reinforces concepts and building of knowledge
    a. Standing waves
    b. Frequency and wavelength and their measurement
    c. Experimental error and pattern development in data sets
    d. Interactions between matter and energy